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Neuroptera Collected from the Krakatau Islands, Indonesia[1)]

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Abstract Four species of Neuroptera, comprising two new species, are recorded from the Krakatau Islands, Indonesia, based on the collection made in 1982 by the Japanese expedition teams almost 100 years after the large, world-famous volcanic eruption of Krakatau in 1883. The total number of Neuroptera found on the islands amounts to 16. One new combination and one new synonymy are proposed.

Introduction

The Krakatau Islands are situated on the Sunda Straits between Java and Sumatra, Indonesia, and recolonization of the islands by plants and animals has received special attention of biologists since 1883 when the islands were thought to be totally sterilized by the large, world-famous volcanic eruption (see THORNTON, 1984, for the history of volcanic activities and of biological surveys). The insect fauna of the Krakataus was surveyed occasionally from 1908 to 1934, but not extensively studied thereafter until 1982. However, in association with the international research program organized by the Indonesian Institute of Sciences (LIPI), the islands and surrounding areas were surveyed by Japanese expedition teams in 1982 (YUKAWA *et al.*, 1986) and by Australian teams in 1984–86 (THORNTON, 1985, 1986, 1987). This paper constitutes a part of the faunistic studies on the insects of the Krakataus and records four species of Neuroptera, comprising two new species, from the islands based on the collection made in 1982 by the Japanese expedition teams. In addition, a generic change is proposed for one species and a specific name is newly synonymized.

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Survey Areas, Materials and Methods

The Krakatau Islands now consist of the following four islets: Rakata Besar (=Rakata; Krakatau; Krakatoa), Rakata Kecil (=Panjang; Lang), Sertung (=Verlaten), and Anak Krakatau (see YUKAWA, 1984, for the map and further details on topography, vegetation and climate of the islands). Neuropterous insects were collected on the islands chiefly by the sweeping and beating in November 1982 by the second author (JY). The specimens were identified and described by examining the type specimens of their relatives and through literature surveys. Colours of the specimens were not sufficiently described owing to considerable discoloration and exudation from the body. The specimens collected, including types, are temporarily in the collection of Kagoshima University, Japan, and are to be deposited in the Zoological Museum, Bogor, Indonesia.

Number of Neuropterous Species Found on the Krakataus

According to DAMMERMAN (1948), three identified and three unidentified species of the Neuroptera were recorded from the Krakataus by 1934. Recently, NEW (in press) sorted out ten species of Neuroptera by examining the collection made in 1984–85 by the Australian expedition teams. The manuscript of his paper includes a description of one new species and six new collection records from the Krakataus, with a discussion on the faunistic features of the Neuroptera on the islands. As described in the present paper, four species of Neuroptera were collected by the Japanese expeditions. One of them, *Myrmeleon frontalis* BURMEISTER has been known to occur on the islands since 1928, but the rest of them were newly collected. Thus, the total species number of the Neuroptera found on the islands amounts to 16, when the collection records of the Australian teams are taken into consideration.

Family Chrysopidae

Italochrysa rugosa TSUKAGUCHI, n. sp.

(Fig. 1)

Female. Length of antenna about 17.0 mm, of forewing 17.1 mm, of hindwing 14.8 mm.

Ground colour probably yellowish-creamy in life. Head as shown in Fig. 1 a; markings absent; vertex flattened; thickness of eye in frontal view slightly larger than a half the distance between eyes. Antenna as long as forewing; scape in frontal view as long as wide; flagellum dark brown. Thorax broadly marked with dark brown on latero-dorsal area, as shown in Fig. 1 b; pronotum transversely broad. Legs without markings; claws dark brown, strongly curved, with very large basal dilatation, as shown in Fig. 1 c. Wing venation as shown in Fig. 1 d. Forewing faintly shaded along some veins near base (Fig. 1 e); pterostigma spotted with

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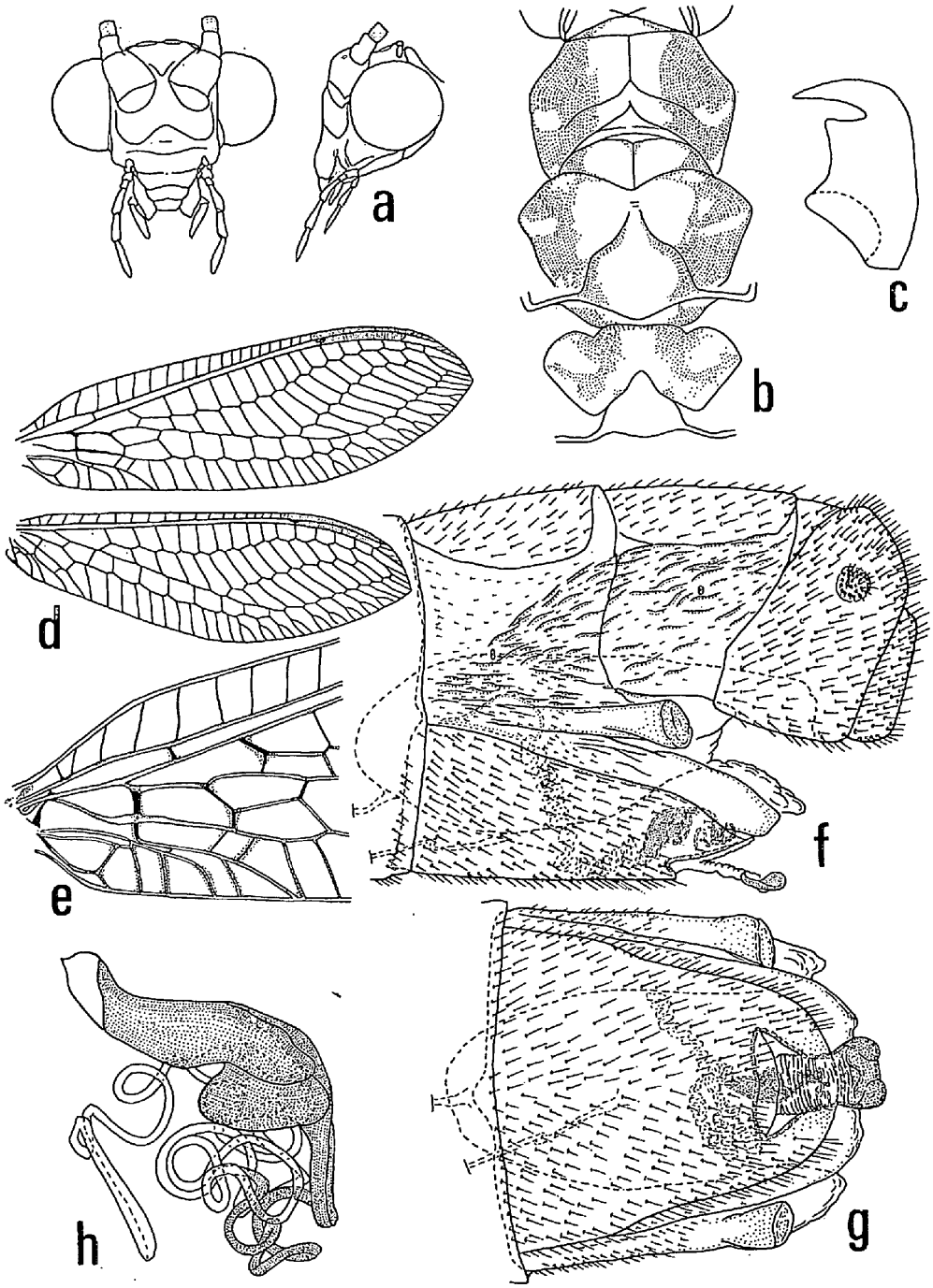

Fig. 1. *Italochrysa rugosa* n. sp., female. —— a, Head (left, frontal view; right, lateral view); b, thorax, dorsal view; c, claws, lateral view; d, right wings; e, proximal part of right forewing; f, abdomen, terminalia, lateral view; g, ditto, ventral view; h, spermatheca, lateral view.

blackish brown at base; longitudinal veins mainly pale, but blackish at most of junctions with crossveins and near proximal parts, as shown in Fig. 1 e; branches of Rs mainly pale, except at junctions with gradates blackish; apical marginal

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branches of M, Cu and A infuscated in some lights; crossveins almost wholly blackish; number of gradates 10/10 (left) and 9/9 (right). Hindwing not shaded; pterostigma spotted with blackish brown at base; veins almost pale, except for most of junctions, costal crossveins of basal two-thirds of wing, R–Rs crossveins of apical half of wing and gradates tinged with blackish brown; number of gradates 9/9. Abdomen simple, without lateral file-like structure on 2nd segment. Spiracles small. All setae very short.

Terminalia: Callus cerci with 39 (left) and 41 (right) trichobothria. Lateral sides of 7th and 8th segments strongly wrinkled, somewhat hardened, with longitudinal dilatation on lower part (Fig. 1 f). Seventh sternite with deep concavity at median part of hind margin (Fig. 1 g). Subgenitale weakly concave through ventral surface of support, with small ventral projection on apical lobe. Spermatheca with long vela separating on mid-dorsal line; ventral impression deep, bent apically; duct very long, strongly coiled (Fig. 1 h).

Holotype: Female, Sertung, Krakataus, 14. XI. 1982, J. YUKAWA leg.

Distribution. Krakataus.

Remarks. This species is somewhat similar to *Italochrysa polychroa* (GERSTACKER, 1893), n. comb.,[3] recorded from Java and Borneo. Although the authors were unable to examine the type specimens of *I. polychroa*, the first author (ST) read through the original description and examined a female Bornean specimen deposited in the Rijksmuseum van Natuurlijke Historie, Leiden, the Netherlands. As the result, this new species is considered to be sufficiently different from *I. polychroa* in the absence of dark brown bands of the femora and the presence of a blackish brown spot at the base of the pterostigma.

The specific name is derived from the extraordinary wrinkles on the lateral sides of the 7th and 8th abdominal segments.

Chrysoperla krakatauensis TSUKAGUCHI, n. sp.

(Fig. 2)

Male. Length of antenna 15.0 mm or so, of forewing 11.1 mm, of hindwing 9.7 mm.

Ground colour probably yellowish green in life. Head as shown in Fig. 2 a; markings entirely absent; vertex roundedly raised; thickness of eye in frontal view almost equal to a half the distance between eyes. Antenna distinctly longer than forewing; scape swollen, somewhat broader than long; flagellum dark brown on basal quarter, becoming paler towards apex. Dorsal side of thorax as shown in Fig. 2 b; yellowish mid-dorsal vitta present; pronotum slightly narrow, indistinctly marked with brown on anterior angle and middle portion of lateral side; mesonotum

3) This species has been placed in the genus *Nothochrysa*, but it should be combined with *Italochrysa*, because of the pseudomedia merging with the outer gradate series and 7th abdominal sternite in the female having no apical extension.

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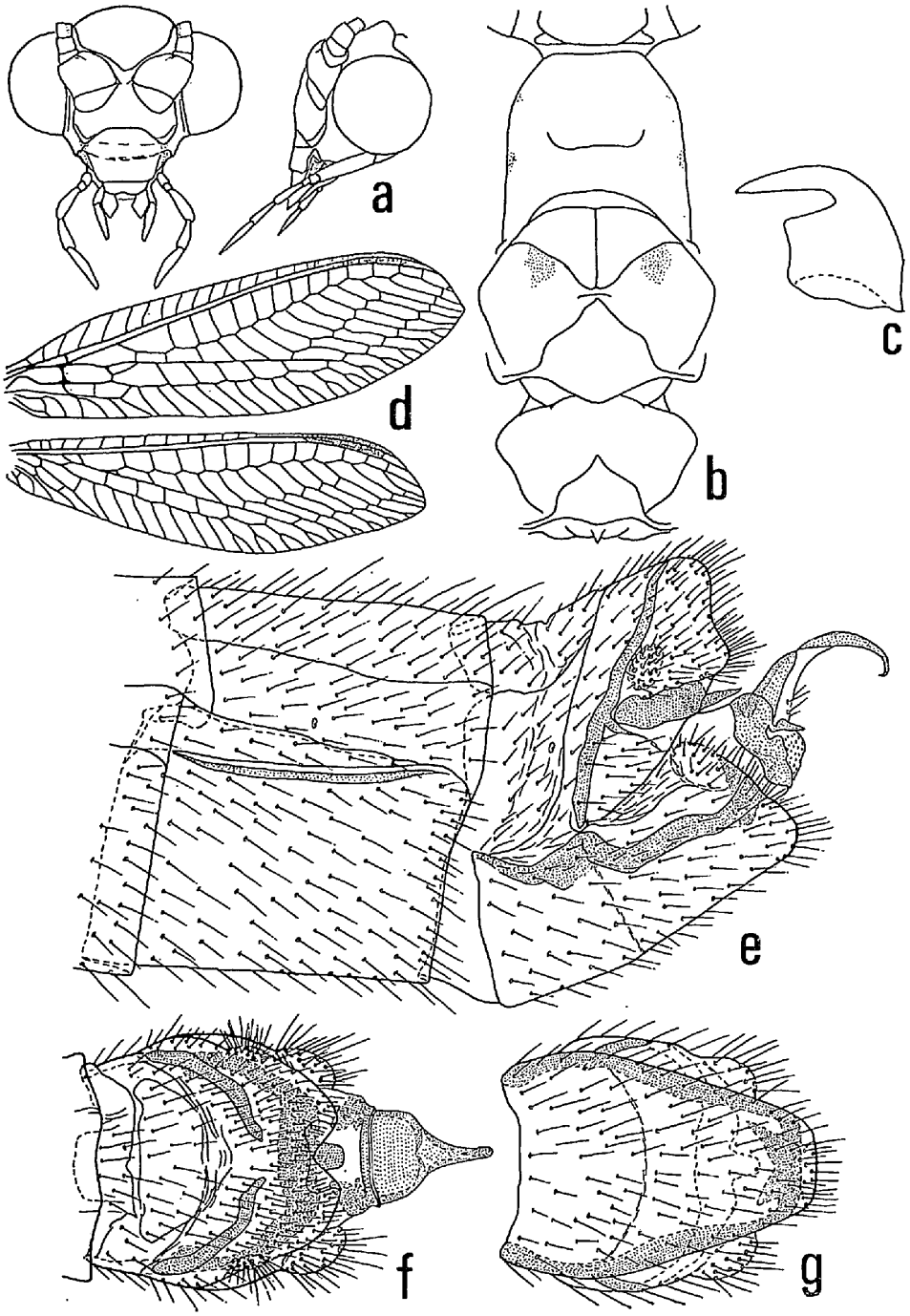

Fig. 2. *Chrysoperla krakatauensis*, n. sp., male. —— a, Head (left, frontal view; right, lateral view); b, thorax, dorsal view; c, claw, lateral view; d, right wings; e, abdomen, terminalia, lateral view; f, ditto, dorsal view (7th segment omitted); g, ditto, ventral view (7th segment omitted).

with obscure, brown marking on scutum. Legs unmarked; claws deep brown, strongly curved, squarely dilated at base, as shown in Fig. 2 c. Wings a little narrow, unspotted, infuscated (Fig. 2 d), except for pale brown spot at base; all

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veins pale green; brown or black veins lacking; cells between two gradate series and posterior cells narrow; tip of cell *im* in forewing a little beyond 1st radio-medial crossvein; number of gradates in forewings 8/9 (left) and 7/9 (right), in hindwings 7/8 (left) and 6/8 (right); Sc and Rs in hindwing separated. Abdomen unmarked; mid-dorsal vitta not found; second segment simple, without lateral file-like structure. Spiracles small. All setae brownish, moderate in length.

Terminalia: Tergite 9+ectproct not separated dorsally, largely cleft below callus cerci (Fig. 2 e); a pair of apodemes extending to dorsal side, not connected with each other dorsally (Fig. 2 f), with short branch under cleft; callus cerci with 29 (left) and 27 (right) trichobothria. Eighth and 9th sternites almost entirely united with each other, faintly delimited by indistict suture (Fig. 2 g), with a pair of small setigerous tubercles before posterior ends of apodemes on upper side of apex, not forming thumb-like projection on ventral tip (Fig. 2 e); a pair of apodemes strongly develped, connected with each other at apices, which form reinforcing plate, as shown in Fig. 2 g. Tignum rather stout; acumen with rounded apex in dorsal view (Fig. 2 f), acute in lateral view (Fig. 2 e). Gonarcus with narrow transverse arc, small lateral piece and additional broad plate in front of transverse arc (the plate is connected with the lateral piece of the gonarcus). Arcessus largely curved in lateral view, pinned apically. Entprocessus small. Four gonosetae present. Spinellae undeveloped. Gonapsis and gonocristae lacking.

Holotype: Male, Sertung, Krakataus, 12. XI. 1982, J. YUKAWA leg.

Distribution. Krakataus.

Remarks. This new species is similar to *Chrysopa malayana* ESBEN-PETERSEN, 1926, recorded from Fort de Kock, Sumatra, but the examination of the type specimen indicates that *C. krakatauensis* clearly differs from *C. malayana* in lacking head markings and having narrower wings. *C. krakatauensis* is also somewhat similar to *Chrysopa ochreacea* ALBARDA, 1881, which is distributed in Sumatra, Java and Bawean, but can easily be distinguished from it by bearing narrower wings, a larger number of the inner gradates (6–8) and the greenish gradates.

According to the recent definition of the chrysopid genera, the generic positions of these *Chrysopa* species should undoubtedly be changed, but the original combinations are used here, because male specimens required for the generic determination have not been available.

Mallada sp.

(Fig. 3)

Female. Length of antenna 12.0–13.5 mm, of forewing 11.0–11.5 mm, of hindwing 10.0–10.5 mm.

Ground colour probably yellowish green or pale green in life. Head as shown in Fig. 3 a; vertex inflated, somewhat depressed in middle; thickness of eye in frontal view somewhat larger than a half the distance between eyes; frontal marking below

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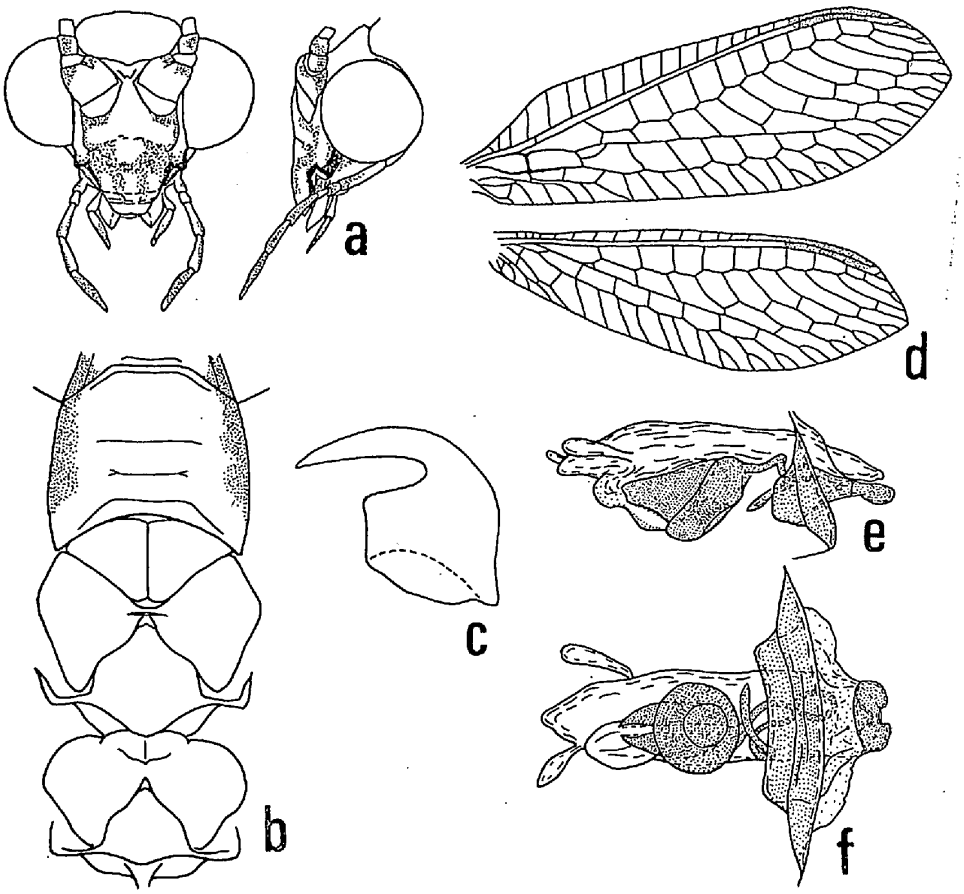

Fig. 3. *Mallada*, sp., female. —— a, Head (left, frontal view; right, lateral view); b, thorax, dorsal view; c, claw, lateral view; d, right wings; e, genitalia, lateral view; f, ditto, ventral view.

antenna and submedian marking on clypeus reddish; genal marking and lateral stripe on clypeus black, edged with red. Antenna somewhat longer than forewing, marked with deep red on outer sides of scape and pedicel. Maxilla faintly tinged with red on anterior half of stipes; palpus blackish brown on outer sides of 1st, 3rd and 4th segments and whole of 5th segment. Labial palpus blackish brown on 3rd segment. Dorsal side of thorax as shown in Fig. 3 b; yellowish mid-dorsal vitta present; pronotum rather broad at middle, tinged with reddish brown along anterior half to two-thirds of lateral side; mesonotum and metanotum without any markings. Legs unmarked; claws deep brown, strongly curved, squarely dilated at base (Fig. 3 c). Wings moderate in width, unspotted, infuscated (Fig. 3 d); veins wholly yellowish green except at base of costal veins faintly tinged with brown; cells between gradate series and posterior cells moderate; tip of cell *im* in forewing distinctly beyond 1st radio-medial crossvein; number of gradates in forewings 4–5/5–6, in hindwings 3–4/4–5; Sc and Rs in hindwing separated. Abdomen unmarked; yellowish mid-dorsal vitta present; second segment simple, without lateral file-like structure. Spiracles small. All setae subhyaline, pale creamy,

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moderate in length.

Terminalia: Callus cerci with 28–31 trichobothria. Seventh sternite simple, not incised. Subgenitale wrinkled, weakly sclerotized on basal support, with one short seta on posterior concavity; apical lobe simple (Fig. 3 f). Spermatheca as shown in Figs. 3 e and f; vela separate dorsally; duct moderate in length. Bursa copulatrix directly connected with vela.

Specimens examined. One female, Chiang Mai, Thailand, 15. IV. 1958, H. IKOMA leg.; one specimen (abdomen missing), same locality, 24. IV. 1958, H. IKOMA leg.; two females, Anak Krakatau, Krakataus, 8. XI. 1982, J. YUKAWA leg.

Distribution. Thailand, Krakataus.

Remarks. The generic position of this species is tentative because the Krakatau collection does not include any male specimen which is fundamentally necessary for generic identification. This species is similar to *Mallada alcestes* (BANKS, 1911) recorded from the Ryukyus, Bonins and India, but can be distinguished from it by having the antenna longer than the forewing, the rectangular genal marking distinctly pigmented with black and the veins wholly yellowish green except at the base of the costal veins faintly tinged with brown.

NAKAHARA and KUWAYAMA (1961) referred one male and seven female specimens collected from Thailand to *Chrysopa esakii* ESBEN-PETERSEN, 1926 (a junior synonym of *M. alcestes*).[4] The first author has examined two female specimens belonging to the Thai series, deposited in the Hokkaido National Agricultural Experiment Station, Japan, and found that they are conspecific with the present Krakatau specimens.

Family **Myrmeleontidae**

Myrmeleon frontalis BURMEISTER

Myrmeleon frontalis BURMEISTER, 1839, Handb. Ent., **2**: 993. Type loc. Java. —— WALKER, 1853, Cat. Neuropt. Brit. Mus., **2**: 401. —— HAGEN, 1866, Stett. ent. Ztg., **27**: 439. —— VAN DER WEELE, 1909, Not. Leyden Mus., **31**: 36. —— ESBEN-PETERSEN, 1913, Not. Leyden Mus., **35**: 230; 1928, Treubia, **10**: 226. —— HANDSCHIN, 1935, Rev. suisse Zool., **42**: 693, 711. —— DAMMERMAN, 1948, Kon. Ned. Akad. Wet., Verhand, (Tweed Sectie), **44**: 490.

Male. Length of antenna 5.2–5.5 mm, of forewing 24.8–25.6 mm, of hindwing 24.7–25.6 mm.

Specimens examined. One male, Rakata Kecil, Krakataus, 10. XI. 1982, J. YUKAWA leg.; one male, Sertung, Krakataus, 14. XI. 1982, J. YUKAWA leg.

Distribution. Krakataus, Java, Flores, Alor, Lomblen, Wetar, Timor.

4) *Chrysopa esakii* was originally described on the basis of one specimen taken at Fort de Kock, Sumatra. As the result of his examination of the male type specimen of this species (which was erroneously treated as a female in the original description), the first author has found that *C. esakii* is a junior synonym of *M. alcestes* [*Mallada alcestes* (BANKS, 1911)=*Chrysopa esakii* ESBEN-PETERSEN, 1926, n. syn.].

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Remarks. *Myrmeleon frontalis* seems to be a common species in Java (ESBEN-PETERSEN, 1928; NEW, in press). Since ESBEN-PETERSEN first found two females on Rakata Besar, this species has been recorded from the three islets of the Krakataus excepting Anak Krakatau up to the present.

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